



APPLICATION NO. 09/826,117

TITLE OF INVENTION: Hybrid Walsh encoder and decoder for CDMA

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## CLAIMS

WHAT IS CLAIMED IS:

10           7. A means for the design and implementation of encoders  
and decoders for Hybrid Walsh complex orthogonal CDMA  
channelization codes over a frequency band with properties

          inphase (real) codes are equal to a lexicographic  
15   reordering permutation of the Walsh code

          quadrature (imaginary) codes are equal to a lexicographic  
reordering permutation of the Walsh code

20           codes have a 1-to-1 sequency~frequency correspondence with  
the DFT codes

          codes have 1-to-1 even~cosine and odd~sine correspondences  
with the DFT codes

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          codes take values  $\{1+j, -1+j, -1-j, 1-j\}$

          codes take values  $\{1, j, -1, -j\}$  with a  $(-45)$  rotation of  
axes and a renormalization

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          codes have fast encoding and fast decoding algorithms

          encoders are implemented in CDMA transmitters for  
representative embodiments as complex multiply channelization

encoding of the inphase and quadrature data replacing the Walsh  
real multiply channelization encoding of the inphase and  
quadrature data, prior to covering by long and short complex PN  
codes

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decoders are implemented in CDMA receivers for  
representative embodiments as complex conjugate transpose  
multiply decoding of the inphase and quadrature encoded data  
replacing the Walsh real multiply decoding of the inphase and  
10 quadrature encoded data, after deconvolving by short and long  
complex PN codes

8. A means for the design and implementation of encoders  
15 and decoders for generalized Hybrid Walsh complex orthogonal CDMA  
channelization codes over a frequency band with properties

codes can be constructed for a wide range of code lengths  
by combining with DFT and quasi-orthogonal PN codes using tensor  
20 product, direct product, and functional combining

codes can be constructed as tensor products with DFT codes  
and quasi-orthogonal PN codes and other codes

25 codes can be constructed as direct products with DFT codes  
and quasi-orthogonal PN codes and other codes and with functional  
combining

codes are complex valued

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codes have fast encoding and fast decoding algorithms

encoders are implemented in CDMA transmitters for  
representative embodiments as complex multiply channelization  
35 encoding of the inphase and quadrature data replacing the Walsh

real multiply channelization encoding of the inphase and quadrature data, prior to covering by long and short complex PN codes

5        decoders are implemented in CDMA receivers for representative embodiments as complex conjugate transpose multiply decoding of the inphase and quadrature encoded data replacing the Walsh real multiply decoding of the inphase and quadrature encoded data, after deconvolving by short and long  
10        complex PN codes

9. A means for the design and implementation of encoders and decoders for complex orthogonal CDMA channelization codes  
15        over a frequency band with properties

inphase (real) codes are equal to a reordering permutation of the Walsh code

20        quadrature (imaginary) codes are equal to a reordering permutation of the Walsh code

codes are complex valued

25        codes have fast encoding and fast decoding algorithms

encoders are implemented in CDMA transmitters for representative embodiments as complex multiply channelization encoding of the inphase and quadrature data replacing the Walsh  
30        real multiply channelization encoding of the inphase and quadrature data, prior to covering by long and short complex PN codes

decoders are implemented in CDMA receivers for  
35        representative embodiments as complex conjugate multiply decoding

of the inphase and quadrature encoded data replacing the Walsh  
real multiply decoding of the inphase and quadrature encoded  
data, after deconvolving by short and long complex PN codes

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10. A means for the design and implementation of encoders  
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decoders are implemented in CDMA receivers for  
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encoded data, after discovering by short and long complex PN codes